

Population process in agriculture

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Population process in agriculture

- Agroecosystems include a collection of interacting populations of many kinds of organisms
- In conventional agriculture the crop plant population is the centre of attention.
- Performance of the crop plant population is maximised by using appropriate inputs managing the environmental complex.

Population process in agriculture

- **In agroecosystems occur complex interactions between populations at the same trophic level and at the same time interactions between populations at different trophic levels.**

Population process in agriculture

- **In sustainable agriculture the entire agroecosystem is the primary concern and is viewed as a collection of interacting populations of many organisms:**
 - Crop species
 - Wild flora and fauna

Population growth

- r = the intrinsic rate of population increase over time = $(N+I) - (M+E)$
- population changes over time: $dP/dt = rP$
- $dP/dt = rP(1-P/K)$
 - K = population size at the carrying capacity of the environment

Population growth

- **In cropping systems human interventions and technologies allow the crop population to increase beyond the normal carrying capacity of the environment.**
 - **Intensive habitat modifications**
 - **Inputs**
 - control or elimination of other species

Colonization of new areas

- The way an organism colonises an area is related to its life cycle.
 - Colonization of new habitats
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 - Important for the non-crop species invading the agroecosystem and establishing populations
 - Colonisation is done in stages:
 - Dispersal
 - Establishment
 - Growth
 - Reproduction
 - In stage of colonization the farmer may intervene:
 - Encouraging the colonisation of desired species
 - Restricted the colonisation of unwanted ones

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Life history strategies

- Species have sets of adaptations that allow them to maintain their populations in their environment over time.
- These adaptations (life history strategies) relate to their life cycle that allows them to ensure reproduction and continuation of their population.
 - Allow populations of organisms to grow
 - Colonize new areas
 - Explain the ecological role of each species in the agroecosystem.
- There is a number of factors that limit the amount of biomass organisms can produce in a given environment
 - Stress
 - Disturbance

Life history strategies

- Species that spent a lot of energy and resources on reproduction have the so called r-strategies
- Their population sizes are limited more by physical factors (harsh environments) than by biotic factors
- They are opportunistic species and occupy open habitats.
- Most of pests and many domesticated plants fall broadly into this category.

Life history strategies

- Species that spent a lot of energy on growth have the so called K-strategies
- Their population sizes are limited more by biotic factors (interference with other populations) than by abiotic factors
- They are long lived and occur in later stages of succession.
- Most organisms display a life history that combines both strategies

Life history strategies

- Species that can adapt to conditions of high disturbance and low stress are called Ruderals (R)
 - Short life span
 - High rate of reproduction
 - Increased colonisation of open environments
- Species that can adapt to conditions of low disturbance and high stress are called stress tolerators (S)
- Species that can adapt to conditions of low disturbance and low stress are called competitors (C)

Ecological niche

- **Ecological niche of an organism is its place and function in the environment.**
 - physical location
 - trophic role
 - limits and tolerances for environmental conditions
 - relation to other organisms

Ecological niche

- **Classical biological control is an example on the niche concept.**
 - A beneficial organism is introduced into an agroecosystem with the purpose to occupy an empty niche.
 - Introduction of an organism that has a less negative impact to the crop.